ORIGINAL RESEARCH

Evaluation of Effectiveness of Graphics Interchange Format and Wong–Baker FACES Pain Rating Scale as Pain Assessment Tool in Children

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Abstract

Aim: The objective of this preliminary study was to evaluate the validity and reliability of the graphics interchange format (GIF) as a self-reporting pain assessment tool in children.

Materials and methods: In this *in vivo* observational study, pain assessment of 42 children aged 7–13 years with a chief complaint of dental pain reporting the first time to the Department of Pediatric and Preventive Dentistry, Government Dental College & Hospital, Nagpur, Maharashtra, India, were included. Informed consent was obtained from the parents or guardians. All the responses were obtained by a single practitioner, after showing the respective self-reporting pain scale, that is, Wong–Baker FACES Pain Rating Scale (WBFPRS) and GIF pain scale. A questionnaire study was performed at the end of the study. The data were recorded, and then statistical analyses were performed.

Results: Both scales showed significant differences ($p = 0.001$*) when scales were individually compared to the actual pain intensity experienced by the patient. Both WBFPRS and GIF pain scales have shown non-significant differences ($p = 0.155$). The GIF pain scale has shown very strong relationship ($r = 0.936$, $p = 0.001$*), while WBFPRS showed strong relationship ($r = 0.725$, $p = 0.001$*). The GIF pain scale has shown almost perfect agreement ($k = 0.911$) whereas WBFPRS has shown substantial agreement ($k = 0.710$) with actual pain intensity. In the questionnaire study, most children strongly agreed that the GIF pain scale is easier to understand than WBFPRS.

Conclusion: The GIF pain scale is a very promising self-report pain assessment tool for children. Further research on improving the GIF pain scale is very important.

Clinical significance: The newly devised GIF pain scale seems to be a very promising self-report pain scale for effective determination of pain experienced by the patient.

Keywords: Graphic interchange format pain scale, Self-reporting pain scale, Wong–Baker FACES pain rating scale.

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Introduction

Pain is an unpleasant sensory and emotional experience associated with actual or potential tissue damage for which the patient seeks health care attention.[1,2] It also determines cooperation thereby affecting the quality of treatment in the health care setting.[3] Therefore, it is essential to determine the pain intensity of the patient before initiating any treatment. However, the assessment of pain is challenged by issues such as age, developmental level, cognitive and communication skills, prior pain experiences, cultural beliefs and norms, fear, and anxiety.[4]

Self-report scales are the commonly used method to assess pain in children. Self-report scales are based on the sensory, emotional, and contextual nature of the noxious stimuli.[5] There are various methods to determine self-report pain, those are linear visual analog scales (VASs),[3,6] graphic and numeric rating scales and thermometer-like derivatives,[7] verbal rating scales, projective measures,[8] selection of colors,[9] poker chips,[10] pain maps with colors to indicate intensity,[11] and interpretation of cartoon pictures.[12] However, these scales are reported to lack concept, validity, reliability, scaling properties, sensitivity, or practical applicability for children.[13,14] Wong–Baker FACES Pain Scale is the most widely accepted and extensively used self-report pain scales in children. Nevertheless, there exists a high possibility that this scale could be difficult for the child to perceive owing to the very similar appearance of the faces used in the scale.[15] Also there is controversy over the affect-laden anchors (smiling anchor for no pain) of the WBFPRS compared to the faces pain scale using neutral anchors.[7] Hence, there is an immense need for a self-report pain scale that would be easy to understand and practically reliable for use in children.

In this research, we have attempted to overcome these disadvantages by a newly designed GIF pain scale. The GIF pain

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scale is a four-point rating scale that provides live action mimicking a real-life situation. This GIF pain scale was developed with the aim to provide a comprehensive and practically reliable pain assessment tool for children. Therefore, this study was planned to compare and evaluate the effectiveness of the newly devised GIF pain scale and WBFPRS as a pain assessment tool in children.

Materials and Methods

This observational study was conducted after obtaining written consent from the parents visiting the OPD of the Department of Pediatric and Preventive Dentistry of the Government Dental College and Hospital, Nagpur, India, from 1 February 2021 to 30 April 2021. This study was approved by the institutional ethical committee, in accordance with 1975 Declaration of Helsinki (IEC/03/13).

This study was conducted on 41 children after determining the validity and reliability of GIF pain scale through a pilot study in 7–13 years children.

Clinical Procedure

Children aged 7–13 years with a chief complaint of dental pain reporting first time to the department of Pediatric and Preventive Dentistry were included in this *in vivo* observational study. Children with any disabilities (auditory, visual, physical, or psychological) that could interfere with their ability to comprehend instructions for completing the pain assessment, previous dental experience, and those who were not willing to participate were excluded from the study.

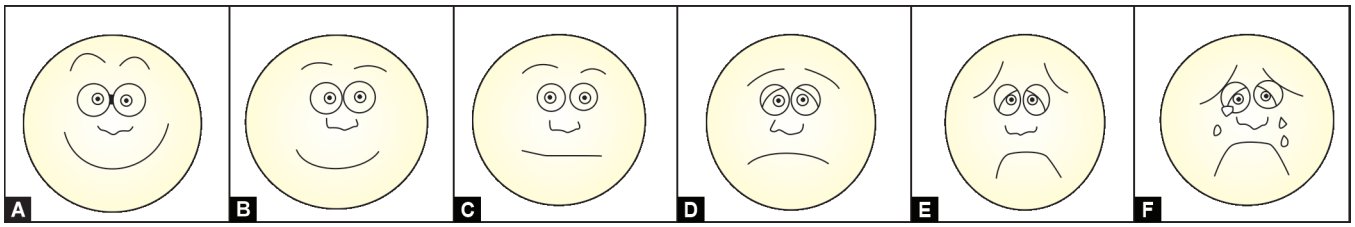
Apparatus

- Wong–Baker FACES Pain Rating Scale demonstrates six faces with increasing degree of pain from left to right, where each face is rated on a scale of 10 in which 0 indicated no hurt, 2 indicated hurts a little, 4 indicated hurts little more, 6 indicated hurts, even more, 8 indicated hurts a whole lot, 10 indicated hurts worst (Figs 1A to F).[16] Details of the WBFPRS were explained to the children and were asked to choose the face that best describes their pain at the time of pain evaluation.
- Graphic Interchange Format pain scale demonstrates 4 GIFs with increasing degree of pain from left to right where each GIF is rated on a scale of 3 in which 0 indicated no pain, 1 indicated mild pain, 2 indicated moderate pain, and 3 indicated severe pain (Figs 2A to D). Details of GIF pain scale were explained to the children and were asked to choose the GIF that best describes their pain at the time of pain evaluation. These GIF were created from videos of patients which were taken following informed consent from patients or their guardians.

Written informed consent was taken from parents/guardians. Thereafter, demographic and clinical data were collected using a standardized data collection form. Specific information pertaining to the pain history, that is, mode of onset, location, type, and intensity of pain was collected. Every child was asked to grade present pain on WBFPRS and GIF pain scale to evaluate pain intensity at the time of interview of the patient. First, WBFPRS was presented to the children, and immediately after that GIF pain scale was shown to them to evaluate their pain intensity.

Since the effectiveness of the GIF pain scale was to be compared with WBFPRS, the scoring criteria of both scales were divided into four pain intensity criteria, that is, no pain, mild pain, moderate pain, and severe pain (Table 1).

A Likert scale questionnaire with eight questions was presented to the participant at the end of data collection to determine the patient's perceptions about the scales used (Table 2).



Figs 1A to F: The WBFPRS: (A) No hurt; (B) Hurts a little; (C) Hurts a little more; (D) Hurts even more; (E) Hurts whole lot; (f) Hurts worst[16]

Figs 2A to D: The GIF pain scale: (A) No pain; (B) Mild pain; (C) Moderate pain; (D) Severe pain

Table 1: Common pain intensity criteria for WBFPS and GIF pain scale for correlation of the scales

Pain intensity criteria	*WBFPS*	*GIF pain scale*
No pain	Score 0: No hurt	Score 0: No pain
Mild pain	Score 2: Hurts a little Score 4: Hurts little more	Score 1: Mild pain
Moderate pain	Score 6: Hurts even more Score 8: Hurts whole lot	Score 2: Moderate pain
Severe pain	Score 10: Hurts worst	Score 3: Severe pain

Table 2: Questions for assessment of children's perceptions of the WBFPRS and GIF pain scale for Likert scale questionnaire study

S. No.	*Questions*
1.	GIF Pain Scale is easy to understand as compared to WBFPS
2.	GIF Pain Scale is confusing to understand as compared to WBFPS
3.	Would you like to recommend the use of GIF Pain Scale in another child?
4.	Would you like to recommend the use of WBFPS in another child?
5.	Do you think any modification is needed in GIF Pain Scale?
6.	Do you think any modification is needed in WBFPS?
7.	Would you like to get your pain evaluated with GIF Pain Scale?
8.	Would you like to get your pain evaluated with WBFPS?

Statistical Analysis

All data were entered into SPSS, v.20, software. A Chi-squared test was performed to compare the actual pain intensity with the GIF pain scale and WBFPRS responses. Correlation with actual pain intensity was done using the Spearman rank correlation test. Kappa statistic was performed for assessment of agreement between the two methods of pain identification. For comparison of correct identification of pain intensity between the two methods, Chi-squared tests were performed. Descriptive statics was used to evaluate the questionnaire regarding the perception of children about the GIF pain scale and WBFPRS.

Results

When both WBFPRS and GIF pain scale were individually compared to actual pain intensity experienced by the patient; in WBFPRS, out of 42 participants, 7 children gave the wrong response when compared to actual pain which was obtained by pain history, while only 2 children gave the wrong response in the case of the GIF pain scale. The two self-report pain scales, that is, both WBFPRS and GIF pain scale were correlated with actual pain experience and to one another. Both scales showed a significant difference (p = 0.001*) [Table 3A, (i) and (ii)].

Both WBFPRS and GIF pain scale have shown non-significant difference (p = 0.155) when the comparison of correct identification of pain intensity between the two methods was evaluated (Table 3B). Nevertheless, GIF pain scale (correct response = 95.1%) has performed better than the WBFPRS (correct response = 82.9%) in determining the pain experience of the children (Table 3B; Fig. 3).

When correlation with actual pain intensity with both the scales were evaluated, GIF pain scale has shown very strong relationship

Table 3: (A) Comparison between the actual pain intensity and responses for (i) WBFPRS and (ii) GIF pain scale, and (B) Comparison of correct identification of pain intensity between two methods

(A) (i) Comparison between the actual pain intensity and responses for WBFPRS

	WBFPRS Score				
Actual pain	*Mild*	*Moderate*	*Severe*	*Total*	*p-value*
Mild	5 (83.3%)	1 (16.7%)	0 (0%)	6 (100%)	0.001*
Moderate	2 (8%)	20 (80%)	3 (12%)	25 (100%)	
Severe	1 (10%)	0 (0%)	9 (90%)	10 (100%)	

Chi-squared test; *Significant difference at $p \leq 0.05$

(A) (ii) Comparison between the actual pain intensity and responses for GIF scale

	GIF Score				
Actual pain	*Mild*	*Moderate*	*Severe*	*Total*	*p-value*
Mild	6 (100%)	0 (0%)	0 (0%)	6 (100%)	0.001*
Moderate	0 (0%)	24 (96%)	1 (4%)	25 (100%)	
Severe	0 (0%)	1 (10%)	9 (90%)	10 (100%)	

Chi-squared test; *Significant difference at $p \leq 0.05$

(B) Comparison of correct identification of pain intensity between two methods

	Correct identification of pain intensity			
Groups	*Yes*	*No*	*χ^2-value*	*p-value*
GIF	39 (95.1%)	2 (4.9%)	3.120	0.155 (NS)
WBFPRS	34 (82.9%)	7 (17.1%)		

Chi-squared test; NS, Non-significant difference

(r = 0.936, p = 0.001*), and WBFPRS showed strong relationship (r = 0.725, p= 0.001*) with the actual pain intensity (Table 4A).

Graphic Interchange Format has shown almost perfect agreement (k = 0.911) with the actual pain intensity of the children. However, WBFPRS has shown substantial agreement (k = 0.710) (Table 4B).

The result of the questionnaire study showed that both scales were equally acceptable to the children. All participants strongly agreed that there is no need for modification in any of the scales used, also they would like to get their pain evaluated and would recommend it to other children for pain evaluation. Except for one child, all the other participants strongly agreed that the GIF pain scale was less confusing than WBFPRS (Table 5). Therefore, within the limitation of this study, it was found that as compared to WBFPRS, GIF got a more accurate response.

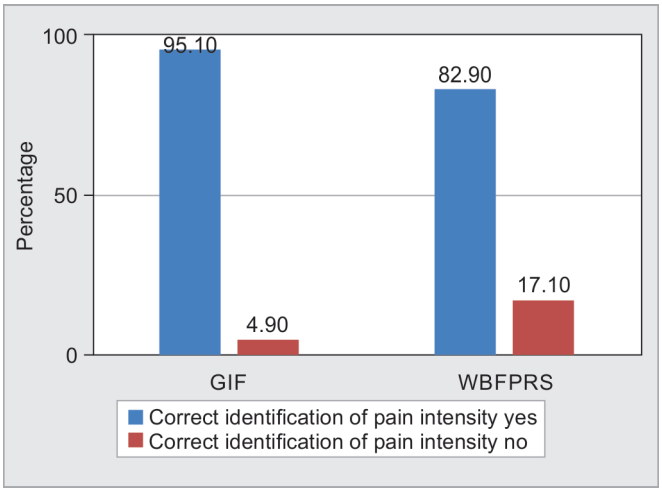


Fig. 3: Comparison of correct identification of pain intensity between two methods

Discussion

Pain is the most important reason for which a patient to seek health care. Therefore, it is imperative for the health care professional to determine the exact pain experience of the patient at the time of reporting. Correct identification of pain experienced by the patient can help the health care provider during diagnosis and treatment planning. Since inadequate pain assessment can be a component associated with under-treatment of pain.[3]

Pain expression is intricately associated with language, and the meaning of the language used is crucial to understanding a person's pain experience. Waddie in1996 stated that using language to express pain not only states its existence and describes its nature but frequently also becomes a part of the pain experience itself.[17] According to McCaffery, 1968 "Pain is whatever the experiencing person says it is, existing whenever the experiencing person says it does".[18] Therefore, in this study we took pain history as the baseline for actual pain experience. Also, in this study children who were cooperative and visited the dentist for the first time were included, since anticipation of treatment involving injection can result in a higher pain rating.[18]

Table 4: Assessment of (A) correlation with actual pain intensity and (B) agreement between two methods of pain identification

(A) Assessment of correlation with actual pain intensity

Pair	*r-value*	*p-value*	*Interpretation*
Actual pain vs GIF	0.936	0.001	Very strong relationship
Actual pain vs WBFPRS	0.725	0.001	Strong relationship

Spearman rank correlation test

(B) Assessment of agreement between two methods of pain identification

Pair	*κ-value*	*Interpretation*
Actual pain vs GIF	0.911	Almost perfect agreement
Actual pain vs WBFPRS	0.710	Substantial agreement

Kappa statistics agreement test

Table 5: Perception of children regarding GIF pain scale and WBFPRS using Likert scale questionnaire

S.No.	*Questions*	*Strongly disagree N (%)*	*Disagree N (%)*	*Undecided N (%)*	*Agree N (%)*	*Strongly agree N (%)*
1.	GIF pain scale is easy to understand as compared to WBFPS			1 (2.4%)		40 (97.6%)
2.	GIF pain scale is confusing to understand as compared to WBFPS	40 (97.6%)		1 (2.4%)		
3.	Would you like to recommend the use of GIF pain scale in another child?					41 (100%)
4.	Would you like to recommend the use of WBFPS in another child?					41 (100%)
5.	Do you think any modification is needed in GIF pain scale?	41 (100%)				
6.	Do you think any modification is needed in WBFPS?	41 (100%)				
7.	Would you like to get your pain evaluated with GIF pain scale?					41 (100%)
8.	Would you like to get your pain evaluated with WBFPS?					41 (100%)

Over the years, clinicians have been trying to incorporate faces resembling human faces in the Oucher Pain Scale, Revised Faces Scale by Baeyer, etc.[19] This was done to improve the reliability of the pain rating scale and to develop a rating scale that has minimal cognitive demands that could be reliably and validly used in young children.[19] This newly devised GIF pain scale consisted of GIFs of children in the dental chair showing live action of different pain intensities mimicking the real-life situation.

Through this study, it is evident that the GIF pain scale is quite a promising self-report pain scale.

In this study, the GIF pain scale has shown very stronger relationship and better agreement with actual pain intensity than WBFPRS showed a strong relationship. Even though WBFPRS and GIF pain scale have shown non-significant differences, GIF pain scale performed better in determining the pain experience of the children. These findings may be due to the fact that children have a limited understanding of pain intensity that is restricted to no, mild, moderate, and severe pain. In this newly devised GIF pain scale, four-point rating scale was used; therefore, it must have been simpler for children to understand it as compared to WBFPRS with six-point rating scale. Additionally, the GIF pain scale showed live action of children with different pain intensity mimicking the real-life situation in a dental chair which WBFPRS lack. This notion was further proved in the questionnaire study where almost all the children strongly agreed that the GIF pain scale is easier to understand than WBFPRS. Our finding is similar to that of Garra et al.[6] and Chambers et al.[20] Garra et al.[6] stated that there exists a high possibility that the WBFPRS scale could be difficult for the child to perceive owing to the very similar appearance of the faces used. Chambers et al.[20] stated that the use of a smiling anchor might affect the pain rating on faces pain scale.

Therefore, through this study, it can be inferred that children had more difficulty understanding the use of WBFPRS than that of GIF pain scale. Even though these self-report pain scales provide a useful method of describing pain experience, but they do not evaluate the multidimensional nature of pain. More sophisticated measures comprise analyses of the sensory, affective, and cognitive components of pain. However, these analyses are not readily available in routine practice. Hence, it can be safely concluded that the GIF pain scale is a very promising self-report pain assessment tool for children.

Limitations

The sample size in this study is small, also only children under the age group of 7–14 years were included and the study population was from a localized area; therefore, the generalizability of the findings of this study may be limited.

Conclusion

The importance of determining the exact pain experience of the children during their visit to the dentist or healthcare system is imperative during the course of the treatment. So far, self-report pain scale is considered to be the best for determining the patient pain experience. However, until now, there is no gold standard pain assessment tool. Therefore, in this regard, our newly devised GIF pain scale might have the potential to be quite a promising self-report pain assessment tool for children.

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